

Claims

1. Thermosetting powder coating composition comprising a co-reactable blend of
 - (i) 5 to 50 weight percent of at least one of glycidyl group containing acrylic copolymer chosen between glycidyl group containing acrylic copolymers (A) having a glass transition temperature in the range of from +45 to +100°C and a number average molecular weight in the range of from 2000 to 5000, glycidyl group containing acrylic copolymers (A') having a glass transition temperature in the range of from -50 to +40°C, and their mixtures;
 - (ii) 5 to 90 weight percent of at least one carboxylic acid group containing polyester chosen between carboxylic acid group containing polyesters (B) having an acid number in the range of from 15 to 100 mg KOH/g and a glass transition temperature in the range of from +45 to +100°C, carboxylic acid group containing polyesters (B') having an acid number in the range of from 15 to 100 mg KOH/g and a glass transition temperature of from -50 to +40°C, and their mixtures;
 - (iii) 5 to 50 weight percent of at least one carboxylic acid group containing acrylic copolymer chosen between carboxylic acid group containing acrylic copolymers (C) having a glass transition temperature in the range of from +45 to +100°C, an acid number of from 10 to 90 mg KOH/g and a number average molecular weight in the range of from 2000 to 5000, carboxylic acid group containing acrylic copolymers (C') having a glass transition temperature in the range of from -50 to +40°C, an acid number of from 10 to 90 mg KOH/g, and their mixtures;
 the weight percentages being calculated on the whole of the components (A), (A'), (B), (B'), (C) and (C'); and
 - (iv) a thermosetting catalyst (D)
 provided that at least one of the low glass transition temperature polymers (A'), (B') and (C') is present in the composition.
2. Composition according to claim 1 wherein the glycidyl group containing acrylic copolymers (A) and (A') have an epoxy equivalent weight of from 1.0 to 10.0 and preferably 1.5 to 5.0 milli-equivalents of epoxy per gram of acrylic copolymer.
3. Composition according to claim 1 or 2, wherein the glycidyl group containing acrylic copolymers (A) and (A') are prepared from 1 to 95 % mole of at least one glycidyl group containing (meth)acrylic monomer selected from glycidyl acrylate, glycidyl methacrylate, methyl glycidyl methacrylate, methyl glycidyl acrylate, 3,4-epoxycyclohexylmethyl(meth)acrylate, 1,2-ethyleneglycol glycidylether (meth)acrylate, 1,3-propyleneglycolglycidylether(meth)acrylate, 1,4-butyleneglycol-ether (meth)acrylate, 1,6-hexanediolether(meth)acrylate, 1,3-(2-ethyl-2-butyl)-propanediolglycidylether(meth)acrylate and acrylic glycidyl ether and 99 to 5 % mole of one or more monomers selected from methyl(meth)acrylate, ethyl(meth)acrylate, propyl(meth)acrylate, n-butyl(meth)acrylate,

- isobutyl(meth)acrylate, tert.butyl(meth)acrylate, 2-ethylhexyl(meth)acrylate, stearyl(meth)acrylate, tridecyl (meth)acrylate, cyclohexyl(meth)acrylate, n-hexyl(meth)acrylate, benzyl(meth)acrylate, phenyl(meth)acrylate, isobornyl(meth)acrylate, nonyl(meth)acrylate, hydroxyethyl(meth) acrylate, hydroxypropyl(meth)acrylate, hydroxybutyl(meth)acrylate, 1,4-butandiolmono (meth)acrylate, the esters of methacrylic acid, maleic acid, maleic anhydride, itaconic acid, dimethylaminoethyl(meth)acrylate, diethylaminoethyl(meth)acrylate, styrene, α -methylstyrene, vinyltoluene, (meth)acrylonitrile, vinylacetate, vinylpropionate, acrylamide, methacrylamide, methylol(meth)acrylamide, vinylchloride, ethylene, propylene, C4-20 olefins and α -olefins .
4. Composition according to any of claims 1 to 3, wherein the carboxylic acid group containing acrylic copolymers (C) and (C') are prepared from :
- 1 to 95 % mole of at least one of acrylic acid, methacrylic acid, crotonic acid, itaconic acid, fumaric acid, maleic acid, citraconic acid or the monoalkylesters of unsaturated dicarboxylic acids and 99 to 5 % mole of one or more monomers selected from methyl(meth)acrylate, ethyl(meth)acrylate, propyl(meth)acrylate, n-butyl(meth)acrylate, isobutyl(meth)acrylate, tert.butyl(meth)acrylate, 2-ethylhexyl(meth)acrylate, stearyl(meth)acrylate, tridecyl(meth) acrylate, cyclohexyl(meth)acrylate, n-hexyl(meth)acrylate, benzyl(meth)acrylate, phenyl (meth)acrylate, isobornyl(meth)acrylate, nonyl(meth)acrylate, hydroxyethyl(meth) acrylate, hydroxypropyl(meth)acrylate, hydroxybutyl(meth)acrylate, 1,4-butandiol mono (meth)acrylate, the esters of methacrylic acid, maleic acid, maleic anhydride, itaconic acid, dimethylaminoethyl(meth)acrylate, diethylaminoethyl(meth)acrylate, styrene, α -methylstyrene, vinyltoluene, (meth)acrylonitrile, vinylacetate, vinylpropionate, acrylamide, methacrylamide, methylol(meth)acrylamide, vinylchloride, ethylene, propylene, C4-20 olefins and α -olefins.
5. Composition according to any of claims 1 to 4 wherein the carboxylic acid group containing polyester (B) is amorphous and has:
- an acid number from 15 to 100 mg KOH/g and preferably from 30 to 70 mg KOH/g.
 - number averaged molecular weight ranging from 1100 to 15000 and preferably from 1600 to 8500, measured by gel permeation chromatography (GPC)
 - an ICI cone and plate viscosity according to ASTM D4287-88, measured at 200°C ranging from 5 to 15000 mPa.
6. Composition according to any of claims 1 to 5 wherein the carboxylic acid group containing polyester (B') is semi-crystalline and has:
- an acid number from 15 to 100 mg KOH/g and preferably from 30 to 70 mg KOH/g
 - a number averaged molecular weight ranging from 1100 to 17000 and preferably from 1400 to 11200

- a fusion zone from 50 to 150°C, measured by Differential Scanning Calorimetry (DSC) according to ASTM D3418 with a heating gradient of 20°C per minute
 - a glass transition temperature (Tg) from -50 to 40°C, measured by Differential Scanning Calorimetry (DSC) according to ASTM D3418 with a heating gradient of 20°C per minute
 - a degree of crystallinity, measured by Differential Scanning Calorimetry (DSC) according to ASTM D3415 of at least 5 J/g and preferably at least 10 J/g
 - an ICI (cone/plate) viscosity according to ASTM D4287-88, measured at 100°C of at least 100 mPa.s.
7. Composition according to any of claims 1 to 6 wherein the carboxylic acid group containing amorphous polyester (B) is obtained of from 50 to 100% mole of terephthalic acid or isophthalic acid or their mixtures and from 0 to 50% mole of at least one aliphatic, cycloaliphatic or aromatic polyacid different from terephthalic acid or isophthalic acid, referring to the polyacid constituents, and from 40 to 100% mole of neopentyl glycol and from 0 to 60% mole of at least one other aliphatic and/or cycloaliphatic polyol, referring to the polyol constituents.
 8. Composition according to any of claims 1 to 7 wherein the carboxylic acid group containing semi-crystalline polyester (B') is obtained of from 70 to 100% mole of terephthalic acid, 1,4-cyclohexanedicarboxylic acid and/or a linear chain dicarboxylic acid containing 4 to 16 carbon atoms and from 0 to 30% mole of at least one other aromatic, aliphatic or cycloaliphatic polyacid, referring to the polyacid constituents, and from 70 to 100% mole of at least one cycloaliphatic or linear chain aliphatic diol containing 2 to 16 carbon atoms and from 0 to 30% mole of at least one other aliphatic polyol, referring to the polyol constituents.
 9. Composition according to any of claims 1 to 8 wherein the carboxylic acid group containing amorphous and/or semi-crystalline polyester is linear or branched and/or comprises polyanhydride end-capped groups .
 10. Composition according to any of claims 1 to 9 wherein the thermosetting catalyst (D) is an amine, phosphine, ammonium salt, phosphonium salt, acid blocked amine or acid blocked phosphine containing compound and is present in an amount of from 0,1 to 5 weight percent with respect to the weight of the total weight of (A), (A'), (B), (B'), (C) and (C').
 11. Thermosetting powder coating composition according to any of claims 1 to 10, containing at least one additive chosen from UV-light absorbers and/or hindered amine light stabilisers, flow control agents and degassing agents.
 12. Thermosetting powder coating composition of claim 11 for use as a clear lacquer.
 13. Thermosetting powder coating composition of claim 11 containing pigments, dyes, fillers.
 14. Process for obtaining a low gloss coating on an article, wherein a thermosetting powder coating composition according to any one of claims 1 to 13 is applied to the

said article by an electrostatic or friction charging spray gun, or by the fluidised bed technique, and in that the article thus coated is cured at a temperature of from 80 to 150°C.

- 5 15. Use of a thermosetting powder coating composition according to any one of claims 1 to 13 to coat metallic and non-metallic surfaces.
16. Use of a thermosetting powder coating composition according to any one of claims 1 to 13 to coat an heat sensitive substrates such as paper, card board, wood, fibre board, textiles, polycarbonates, poly (meth)acrylates, polyolefins, polystyrenes, polyvinylchlorides, polyesters, polyurethanes, polyamides, copolymers of
10 acrylonitrile butadiene styrene and cellulose acetate butyrate.
17. Entirely or partially coated substrate using the process of claim 14.